

SQA Advanced Unit specification

General information

Unit title: Design Methodology (SCQF level 7)

Unit code: HV1E 47

Superclass: VF

Publication date: November 2017

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to introduce learners to the methods applied when designing a product. It allows the learner to develop knowledge and skills which will allow them to understand the processes involved in the successful development/design of a product.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Identify the key stages of the design process.
- 2 Apply appropriate design planning methods in relation to a given design specification.
- 3 Develop design concepts using appropriate design methodologies in response to a given design specification.
- 4 Evaluate design concepts in response to a given design specification.

Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Access is at the discretion of the centre. However, learners should possess a basic knowledge and understanding of design. This may be evidenced by the possession of SQA Advanced Units in Computer Aided Draughting, and/or a Higher in Graphical Communication or Craft and Design or equivalent.

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Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Where at all possible the Unit should be delivered with a generic approach to the design process. It may be linked/integrated with the following Units in *Computer Aided Draughting and Design: Graded Unit 1, CAD: Visualisation, Rendering and Presentation* and *CAD: Principles*.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Identify the key stages of the design process.

Knowledge and/or Skills

- ◆ Customer needs:
 - primary
 - secondary
- ◆ Design specification
- ◆ Project planning
- ◆ Concept generation techniques
- ◆ Evaluation and solution selection
- ◆ Analysis and synthesis:
 - design form (aesthetics, ergonomics and anthropometrics)
 - method of operation
 - method of manufacture
 - manufacturing tolerances
 - material selection
 - costing
- ◆ Modelling and testing:
 - CAD
 - Prototyping

Outcome 2

Apply appropriate design planning methods in relation to a given design specification.

Knowledge and/or Skills

- ◆ Gantt/bar chart
- ◆ Network diagrams
- ◆ Network events table
- ◆ Network activity table
- ◆ Critical path analysis

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Outcome 3

Develop design concepts using appropriate design methodologies in response to a given design specification.

Knowledge and/or Skills

- ◆ Design concept methodologies
- ◆ Concept sketches

Outcome 4

Evaluate design concepts in response to a given design specification.

Knowledge and/or Skills

- ◆ Techniques to evaluate the design concept:
 - selection matrix
 - criteria ranking
 - criteria weighting

Evidence Requirements for this Unit

Outcome 1

A learner's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the learner is able to:

- ◆ produce a written response that identifies the key stages of the design process and explains the purpose of each stage in the process.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Learners should be allowed to refer to relevant course material.

Outcome 2

A learner's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the learner is able to:

- ◆ produce a Gantt chart detailing a general plan for the development of the product, consistent with a given design specification.
- ◆ produce a written summary on the use of network diagrams and tables in relation to design planning.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Learners should be allowed to refer to relevant course material.

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Outcome 3

A learner's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the learner is able to:

- ◆ create a minimum of three individual concept designs, consistent with a given design specification, including:
 - sketches
 - short textual description for each of the concept designs detailing how each design satisfies the needs included in the PDS document
- ◆ give a short oral presentation identifying key concepts of each design.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Learners should be allowed to refer to relevant course material.

Outcome 4

A learner's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the learner is able to:

- ◆ demonstrate the ability to apply appropriate methods of concept evaluation through the use of selection matrix, criteria weighting and ranking tables.
- ◆ produce a short written summary of the outcome of the evaluation process and identify the preferred design solution.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Learners should be allowed to refer to relevant course material.

SQA Advanced Unit Support Notes

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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow learners to develop knowledge, understanding and skills in the following areas:

- 1 Identification of the key stages of the design process.
- 2 Application of appropriate design planning methods in relation to a given design specification.
- 3 Development of design concepts using appropriate design methodologies in response to a given design specification.
- 4 Evaluation of design concepts in response to a given design specification.

This Unit is at SCQF level 7 and may form part of a group award or be completed as a free-standing Unit.

In designing this Unit, the Unit writer has identified the range of topics that would be expected to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome assessment. This has been done to help lecturers decide what depth of treatment should be given to the topics attached to each of the Outcomes. While it is not mandatory for centres to use this list of topics, it is recommended that they do so as the Assessment Support Pack (ASP) for this Unit is based on the Knowledge and/or Skills and list of topics in each of the Outcomes.

A list of topics for each Outcome is given below. Lecturers are advised to study this list in conjunction with the Assessment Support Pack (ASP) so that they can get a clear indication of the standard of achievement expected of learners in this Unit.

Outcome 1

Identify the key stages of the design process (5 hours)

In this Outcome the learner should be able to identify the key activities of the design process. The learner is required to produce a written response to identify the key stages of the design process and explain the purpose of each stage in the process. The report should give a clear and broad overview of the stages of the design process. This should include the following:

- ◆ Customer needs:
 - primary
 - secondary
- ◆ Design specification
- ◆ Project planning
- ◆ Concept generation techniques
- ◆ Evaluation and solution selection

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- ◆ Analysis and synthesis:
 - design form (aesthetics, ergonomics and anthropometrics)
 - method of operation
 - method of manufacture
 - manufacturing tolerances
 - material selection
 - costing
- ◆ Modelling and testing:
 - CAD
 - Prototyping

Outcome 2

Apply appropriate design planning methods in relation to a given design specification.
(5 hours)

In this Outcome the learner should be able to apply appropriate design planning techniques and identify the sequence of activities in relation to a given design specification. Evidence of this will be produced in the form of a Gantt chart. The Gantt chart should formalise the sequence of activities and their allotted timescale within the design process.

Learners are also required to write a summary of the use of network diagrams and tables in relation to design planning.

Outcome 3

Develop design concepts using appropriate design methodologies in response to a given design specification. (15 hours)

In this Outcome the learner should be introduced to methods, which are commonly utilised in the design/development of a product, for example:

- ◆ group stimulus
- ◆ lateral thinking

Basic consideration should be given to:

- ◆ design form (aesthetics, ergonomics and anthropometrics)
- ◆ method of operation
- ◆ method of manufacture
- ◆ manufacturing tolerances
- ◆ material selection

The concept sketches required for this Outcome should be in the form of simple pencil sketches, showing the appropriate level of detail required to convey the design idea. Notes should be added to the sketches to help in the communication of the design concepts. The concept sketches should be accompanied by a short half page report detailing the key features of the design concepts in relation to the design specification.

The learner should give a brief oral presentation identifying the key concepts of each design lasting no more than 10 minutes.

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Outcome 4

Evaluate design concepts in response to a given design specification. (5 hours)

In this Outcome the learner looks at the techniques utilised to evaluate concept designs. Evaluation techniques as detailed below should be used to formalise the evaluation process:

- ◆ selection matrix:
 - criteria ranking
 - criteria weighting

The learner should produce a short half page report to accompany the selection matrix, which summarises the findings and identifies the selected solution.

Guidance on approaches to delivery of this Unit

It is intended that this Unit be presented at all times using the specialist application CAD software available at the centre. Appropriate technical and support material should be available to the learner.

In delivery of this Unit, learners should be provided with the opportunity to gain as much 'hands on' experience as possible. Each learner should have access to a PC with the CAD software installed.

Details on approaches to assessment are given under Evidence Requirements and Assessment Guidelines under each Outcome in the SQA Advanced Unit specification; Statement of Standards section. It is recommended that these sections be read carefully before proceeding with assessment of learners.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Assessment should be conducted under controlled, supervised conditions.

Outcome 1 should consist of a written report. Outcomes 2, 3 and 4 should be both written and practical.

The assessment for Outcome 1 in this Unit should be taken by learners at one single event that should last one and a half hours. Learners should be allowed to refer to relevant course material. Outcomes 2, 3 and 4 could be assessed by a single instrument of assessment in the form of an assignment. This assignment may be completed as a group activity. The learners will be required to collaborate and produce a single document, which satisfies Outcomes 2, 3 and 4. A set of simple sketches of the design concepts will also be required as detailed in Outcome 3. The assignment should be completed in ten hours. Learners should be allowed to refer to relevant course material. This assignment should be carried out at the end of the delivery of the Unit.

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It would also be possible to break this assessment down into four separate assessment events, which assess each Outcome separately.

The assessment for Outcome 2 in this Unit could be taken by learners at one single event that should last one and a half hours. Learners should be allowed to refer to relevant course material.

The assessment for Outcome 3 in this Unit could be in the form of an assignment. The assignment tasks should involve the creation of simple hand drawn sketches of the concept designs and writing a short textual description for each of the concept designs. The assignment should be completed in five and a half hours. Learners should be allowed to refer to relevant course material. This assignment should be carried out at the end of the delivery of the Unit.

The assessment for Outcome 4 in this Unit could be taken by learners at one single event that should last one and a half hours. Learners should be allowed to refer to relevant course material.

It should be noted that learners must achieve all the minimum evidence specified for each Outcome in order to pass the Unit.

It is essential that the Centres ensure that evidence generated is the learner's own work.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills of *Problem Solving*, *Communication* and *Working with Others* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Learners will be required as they produce solutions to a given brief to analyse and seek solutions to a range of theoretical and practical problems and issues as they identify and work towards specific objectives. Identifying and considering the variables, including all available resources, and analysing the relative significance of each before identifying and justifying an appropriate strategic approach will provide opportunities to develop elements of planning, critical thinking and general problem solving skills to an advanced level. Analysing and evaluating the potential impact of proposed strategies will be a critical aspect of underpinning knowledge and understanding, and learners should identify appropriate evaluative methods to measure achievement.

Although communication skills are not formally assessed learners will be expected to analyse, produce and present written and oral materials to standards acceptable in industry, and to express essential ideas and information accurately and coherently. They should ensure that the information they communicate has been considered, is accurate and is

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effectively presented to meet the needs of purpose and users. Presentations should demonstrate that learners are able to:

- ◆ collate, organise and structure accurate information effectively.
- ◆ signpost key points.
- ◆ select and produce support materials for their impact.
- ◆ use appropriate non-verbal communication techniques.
- ◆ respond to any questions in a way that progresses communication.

In undertaking Outcome 1 learners may benefit from awareness raising on current business communication theories on approaches to dealing with the internal and external customer as a key element in the Design Process. There are practical opportunities to foster skills in co-operative working as learners discuss and make interim presentations of proposed solutions to their peers, where they may:

- ◆ orally analyse the task and its component elements.
- ◆ negotiate the nature and scope of goals, roles and responsibilities taking account of all resources including strengths and weaknesses of individuals.
- ◆ negotiate rules for effective management of the group and task.
- ◆ demonstrate the use of working methods consistent with available resources.
- ◆ demonstrate and explain methodology to others.
- ◆ review and evaluate their own performance as a communicator.

History of changes to Unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

General information for learners

Unit title: Design Methodology (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit has been designed to provide you with the knowledge and skills that will enable you to understand the basic concepts of design methodology.

This Unit will also allow you to develop practical skills that will enable you to create part and assembly drawings.

Outcome 1	Written	1.5 hours
Outcome 2	Written/practical	1.5 hours
Outcome 3	Written/practical	5.5 hours
Outcome 4	Written/practical	1.5 hours

You will be allowed access to all course notes during the assessment event.

At the discretion of the individual centres, all Outcomes can be carried out after the teaching of the appropriate topics or as an integrated assignment. This will not usually be attempted until all teaching has been completed.